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AMBLYOMMA BABIRUSSAE SCHULZE (ACARI: IXODIDAE): REDESCRIPTION OF THE MALE, FEMALE, AND NYMPH AND DESCRIPTION OF THE LARVA

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Abstract.—The male, female and nymph of *Amblyomma babirussae* Schulze are redescribed and the larva is described for the first time. Adults and immatures are illustrated with black and white and color drawings and with scanning electron photomicrographs of specimens collected primarily on artiodactyl mammals and from vegetation on the island of Sulawesi, Indonesia.

Amblyomma babirussae was originally described from two collections. The first contained 3 males, 7 females and 2 nymphs from *Sus babirussa,* "Vaterland Boeroe oder Celebes." This might be the island of Boeroe (03.24S, 126.40E) or some locality unknown to us but named Boeroe on present-day Sulawesi. The second collection contained 3 nymphs from Minahassa, northern Celebes, collected by O. Warburg. The only other taxonomic study of *A. babirussae* was by Anastos (1950) who saw 15 males, 9 females, 18 nymphs and 1 larva in three collections, all from Sulawesi.

When the Hoogstraal tick collection was transferred from Cairo, Egypt, to the Museum Support Center, Smithsonian Institution, in November of 1986, we found 95 collections of *A. babirussae,* all from Sulawesi. Most of these specimens were collected by members of U.S. Naval Medical Research Unit No. 2, Jakarta Detachment, especially W. P. Carney, J. F. Duncan, S. W. Joseph and P. F. D. Van Peenen. We thank these collectors for donating their material to Dr. Hoogstraal's tick collection.

A. babirussae remains an unfamiliar species to most tick workers. For this reason, we have decided to redescribe in detail the male, female and nymph and to describe the hitherto unknown larva. In the following account, all measurements are in millimeters. A range is given followed by a mean in parentheses. Ticks were prepared for scanning electron microscopy by the method of Corwin et al. (1979).

Amblyomma babirussae Schulze 1933

Amblyomma babirussae Schulze 1932: 525 [*nomen nudum*].

Amblyomma babirussae Schulze 1933: 317, figs. 1–5, original description.

Amblyomma cyprium Krijgsman & Ponto 1931: 141, 143; 1932: 121, 122, figs. 25, 26 [*nec* Neumann, 1899].

Amblyomma cyprium Toumanoff 1944: 110, pl. 78, figs. c, d (♂ only, not ♀) [*nec* Neumann, 1899].

Male (Figs. 1–5).—Length from scapular apices to posterior body margin 2.88–3.52 (3.13); width 2.38–3.00 (2.72), widest at level

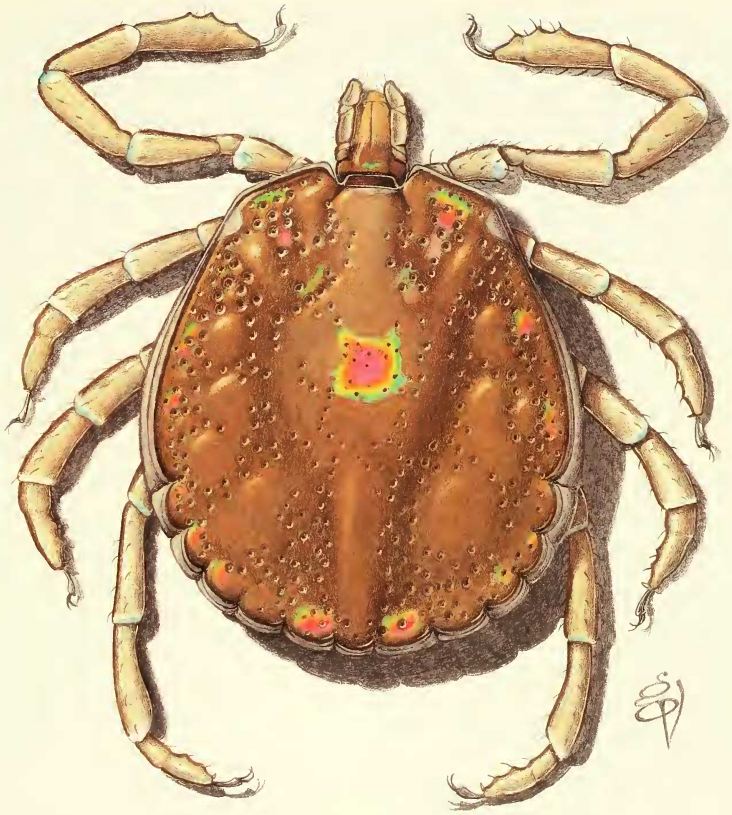
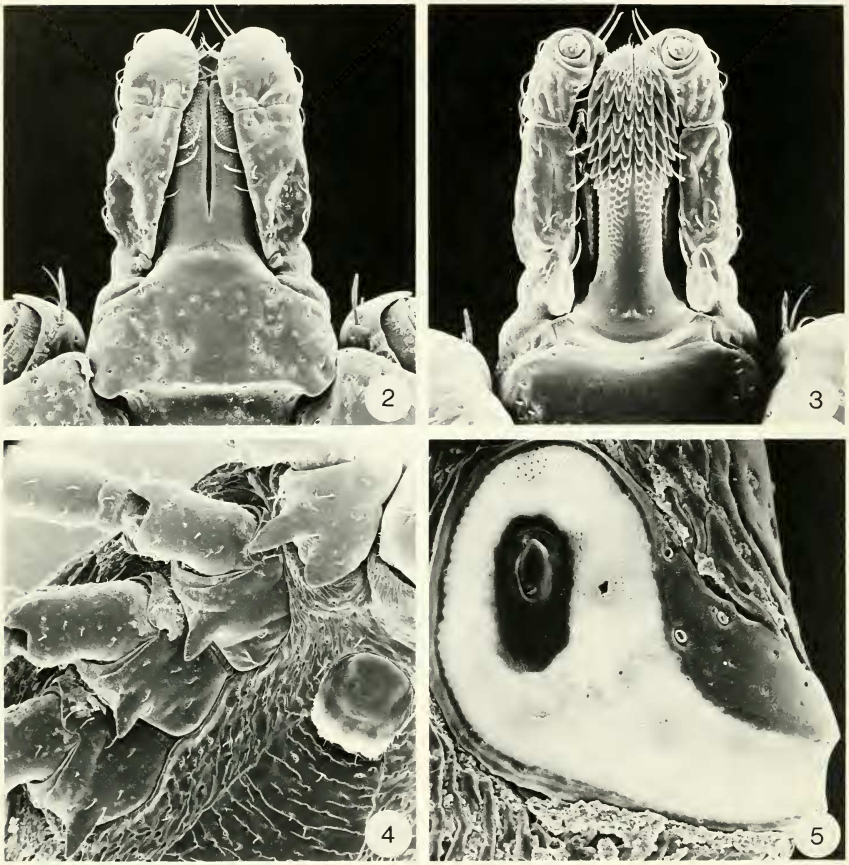


Fig. 1. *Amblyomma babirussae* ♂ SULAWESI (RML 99981). Dorsal view.

of spiracular plates, outline broadly oval. *Scutum* (Fig. 1) ornate, typically with a large iridescent reddish-orange spot encircled with a band of yellow and green located at the posterior angle of the pseudoscutum. The remaining ornamentation is found peripherally, ranging from an almost continuous orange/yellow stripe encircling the scutum, including spots on all festoons, to almost no ornamentation except the central spot. Ornamentation in Fig. 1 is typical except most males lack the slight coloration on the dorsum of the basis. Punctations large and deep marginally, a few slight, shallow punctations centrally. Scutum with roughened appearance due to raised pseudoscutal area and central extension toward festoon six. *Marginal groove* absent. *Cervical grooves* narrow, extending laterad from emargination to short cervical pits. Eyes small, flat, level with scutal surface.

Capitulum (Figs. 2, 3): Length from palpal apices to cornua apices 0.755–0.952 (0.851), width 0.465–0.635 (0.535); *basis capituli* dorsally subrectangular, ornamentation found on one of ten specimens; pos-



Figs. 2–5. *Amblyomma babirussae* ♂ SULAWESI (RML 118497). 2, Capitulum, dorsal view (95×). 3, Capitulum, ventral view (106×). 4, Coxae I–IV (74×). 5, Spiracular plate (212×).

terior margin straight between short, broadly triangular cornua. *Palpi* length 0.332–0.621 (0.521), width 0.189–0.247 (0.214); average lengths of segments II and III, 0.292 and 0.202 respectively. Palpal segment II dorsally with a narrow posterointernal ridge; suture between segments II and III distinct. *Hypostome* (Fig. 3) length 0.382–0.534 (0.468) including teeth, crenulations, and stalk to base, bluntly rounded apically; dental formula 4/4, teeth of files 1–4 number 6–7 (6.40), 6–8 (6.40), 5–7 (6.20) and 5–8 (6.50) respectively; apex with a large corona of fine denticles.

Legs (Fig. 4) moderate in length, trochanter, femur and tibia often with a greenish-blue ring at segment's distal end. Coxa I with a moderately long, broadly rounded

internal spur and a long, lanceolate external spur; coxa II with a very small internal protuberance, arising anterior to but not reaching the posterior margin of coxa II, and an elongate narrowly triangular external spur; coxae III and IV each with an external spur similar to that on coxa II, internal spurs absent. *Trochanters* without spurs. *Tarsus* I abruptly tapered distally, 0.680–0.858 (0.763) long, 0.191–0.253 (0.222) wide. Tarsus IV gradually tapered distally, 0.513–0.691 (0.609) long, 0.144–0.194 (0.171) wide.

Genital aperture (Fig. 4) at level of coxae II. *Spiracular plate* (Fig. 5) with a narrowly elongate dorsal prolongation.

Descriptive statistics for principal characters of males are summarized in Table 1.

Female (Figs. 6–10).—Length (unfed, exclusive of capitulum) 3.16–3.93 (3.64), width 2.62–3.30 (3.01). *Scutum* (Fig. 6) length 1.55–1.91 (1.76), width 1.91–2.25 (2.10), outline as illustrated; scapulae large, bluntly rounded. Ornamentation variable but almost always a reddish-orange spot encircled by a narrow yellow band and an outer greenish band located in the posterior scutal angle. This spot is of the same color and in the same location as that of the male (Fig. 1). Diffuse ornamentation of the same reddish-yellow color in cervical area from scapula to eye, background color brown. *Eyes* flat, at lateral angles. *Cervical grooves* narrowly elongate, comma-shaped, usually containing punctations. Punctations large and numerous over scutum except centrally

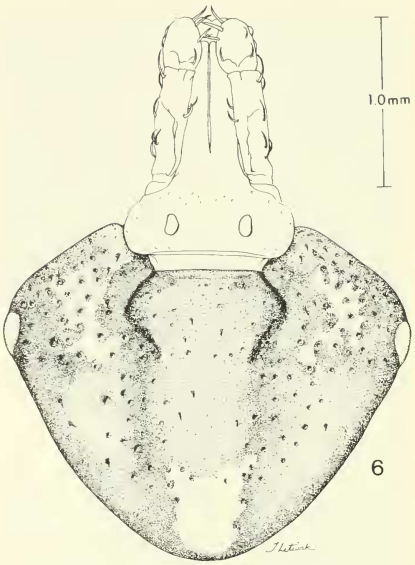
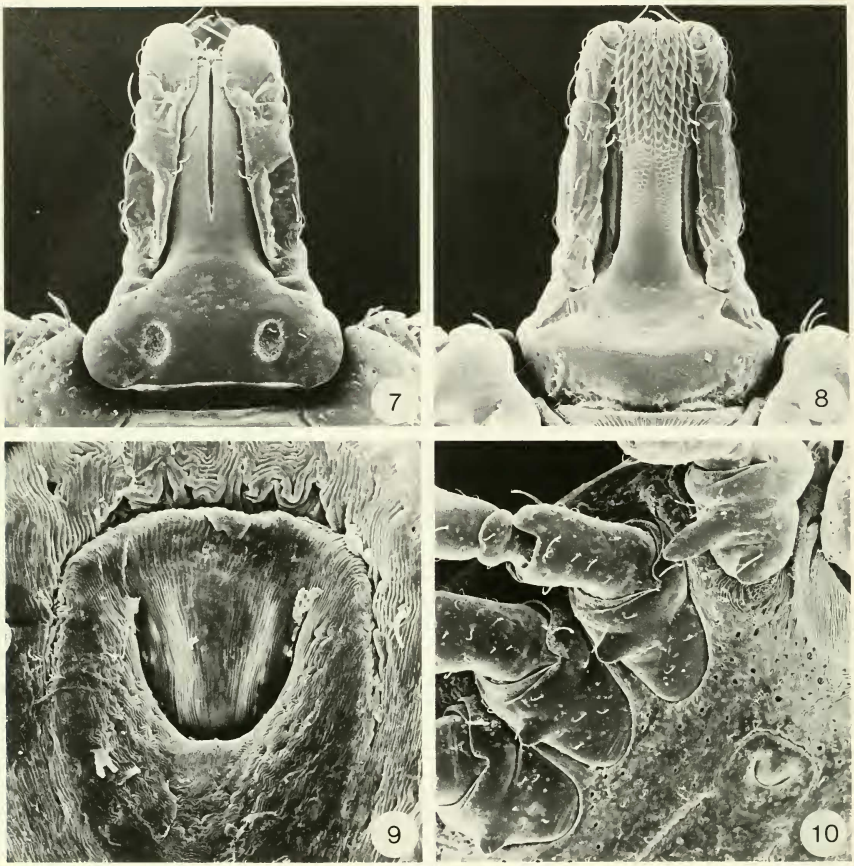


Fig. 6. *Amblyomma babirussae* ♀ SULAWESI (RML 99967). Scutum.

Table 1. *Amblyomma babirussae*: Descriptive statistics for measurements from 10 unengorged males.

Measurement	Mean with Standard Error	Standard Deviation	Coefficient of Variation
Body: length	3.13 ± 0.07	0.22	7.03
width	2.72 ± 0.06	0.20	7.35
Capitulum: length	0.851 ± 0.017	0.054	6.35
width	0.535 ± 0.015	0.048	8.97
Palps: length	0.521 ± 0.025	0.078	14.97
width	0.214 ± 0.006	0.020	9.35
Hypostome: total length	0.468 ± 0.015	0.047	10.04
Tarsus I: length	0.763 ± 0.021	0.065	8.52
width	0.222 ± 0.007	0.021	9.46
Tarsus IV: length	0.609 ± 0.018	0.058	9.52
width	0.171 ± 0.005	0.015	8.77



Figs. 7–10. *Amblyomma babirussae* ♀ SULAWESI (RML 99967). 7, Capitulum, dorsal view (64×). 8, Capitulum, ventral view (74×). 9, Genital aperture (318×). 10, Coxae I–IV (64×).

and posterolaterally. Dorsum of body with numerous large white setae; *marginal groove* absent.

Venter with fewer, smaller white setae than on dorsum. *Genital aperture* (Figs. 9, 10) U-shaped, without thickened areas or flanges, situated medially at posterior margin of coxae II or between coxae II and III. Spiracular plates essentially as in male.

Capitulum (Figs. 7, 8) length from palpal apices to posterior margin of basis capituli 1.09–1.37 (1.27), width 0.751–0.892 (0.837); porose areas deep, elongate in anterior–posterior plane, diameter of one area 0.090–0.124 (0.111); interporose area 0.245–0.379 (0.278); 4 of 10 specimens with slight ornamentation in the interporose area; external margin of basis broadly convex; cornua

absent or indicated by slight protuberances. Ventrally, basis as figured (Fig. 8) with several minute white setae at each posterolateral angle. *Palpi* length 0.724–0.980 (0.823), width 0.216–0.287 (0.258); average lengths of segments II and III, 0.494 and 0.271 respectively; palpal segment II dorsally with an anteriorly broadening mesal ridge. *Hypostome* (Fig. 8) total length 0.732–0.832 (0.781); dental formula 4/4; teeth of files 1–4 number 7–9 (8.00), 7–9 (7.67), 6–9 (7.67), 6–9 (7.78) respectively; apex indented, with a large corona of fine denticles.

Legs (Fig. 10) moderate in length, trochanter, femur and tibia often with greenish-blue markings at segment's distal end. Spurring of coxae I–IV as in ♂ except external spurs of II–IV are broadly rounded rather than pointed. Some ♀ specimens lack the very small internal protuberance on coxa II. *Trochanters* without spurs. *Tarsus* I abruptly tapered distally, 0.831–1.060 (0.932) long, 0.212–0.298 (0.260) wide. Tarsus IV gradually tapered distally, 0.585–0.780 (0.673) long, 0.157–0.210 (0.189) wide.

Descriptive statistics for principal characters of females are summarized in Table 2.

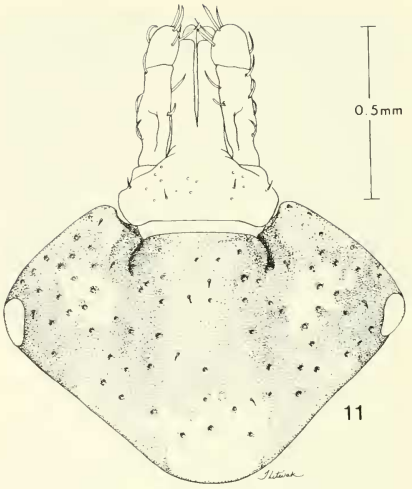
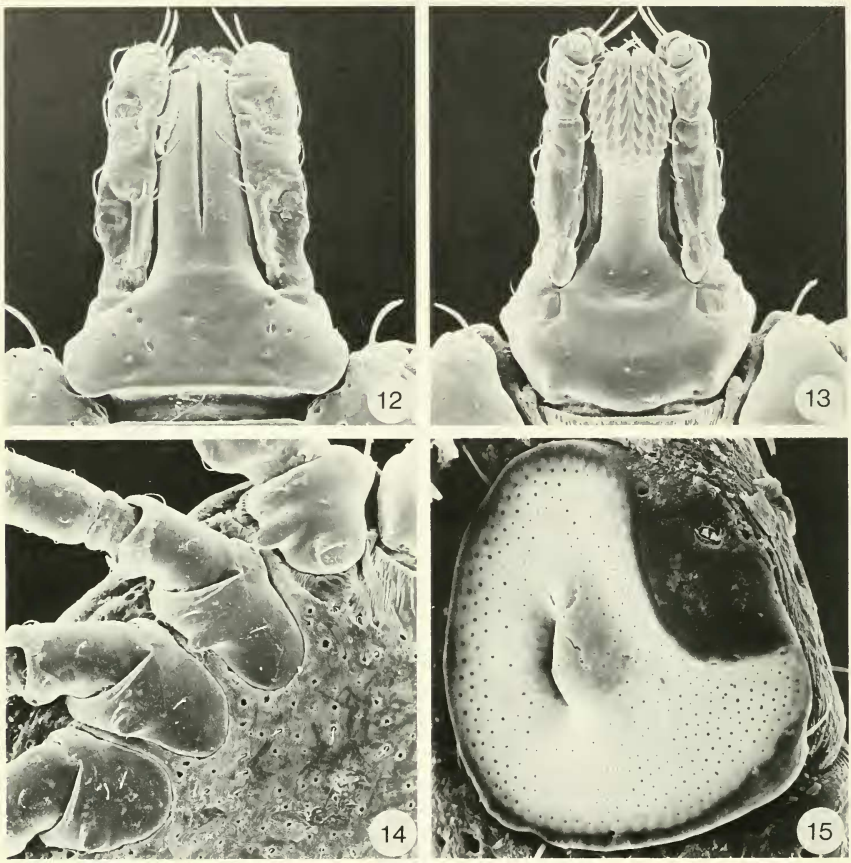


Fig. 11. *Amblyomma babirussae* Nymph SULAWESI (RML 99968). Scutum.

Nymph (Figs. 11–15).—Measurements from 15 unengorged specimens. *Body.* Length from scapular apices to posterior body margin 1.315–1.562 (1.453); width 1.215–1.426 (1.318), widest at level of coxa

Table 2. *Amblyomma babirussae*: Descriptive statistics for measurements from 10 unengorged females.

Measurement	Mean with Standard Error	Standard Deviation	Coefficient of Variation
Body: length	3.64 ± 0.08	0.24	6.59
width	3.01 ± 0.06	0.19	6.31
Scutum: length	1.76 ± 0.04	0.13	7.39
width	2.10 ± 0.03	0.11	5.24
Capitulum: length	1.27 ± 0.03	0.10	7.87
width	0.837 ± 0.014	0.044	5.26
Palps: length	0.823 ± 0.028	0.090	10.94
width	0.258 ± 0.006	0.020	7.75
Porose area: diameter	0.111 ± 0.003	0.011	9.91
Interporose area	0.278 ± 0.013	0.040	14.39
Hypostome: length	0.781 ± 0.010	0.030	3.84
Tarsus I: length	0.932 ± 0.023	0.074	7.94
width	0.260 ± 0.009	0.028	10.77
Tarsus IV: length	0.673 ± 0.016	0.051	7.58
width	0.189 ± 0.005	0.016	8.47



Figs. 12–15. *Amblyomma babirussae* Nymph SULAWESI (RML 99968). 12, Capitulum, dorsal view (159×). 13, Capitulum, ventral view (138×). 14, Coxae I–IV (127×). 15, Spiracular plate (424×).

IV; dorsum of idiosoma with 35–50 (41) long, stout setae, concentrated laterally and posteriorly. *Scutum* (Fig. 11). Length 0.658–0.786 (0.725), width 0.928–1.083 (1.017); cervical grooves short, comma-shaped, with several large, deep punctations; iridescent golden red/green patches more or less well developed between borders of eyes and cervical grooves and at posterior angle of scutum; punctations larger and more numerous laterally than mesally, those in posterior iridescent patch ranging in number from 1 to 7 (3).

Capitulum (Figs. 12, 13) length from posterior margin of cheliceral sheaths to posterior capitular margin 0.172–0.230 (0.206); width at level of scapulae 0.377–0.436 (0.399). *Basis capituli* dorsally (Fig.

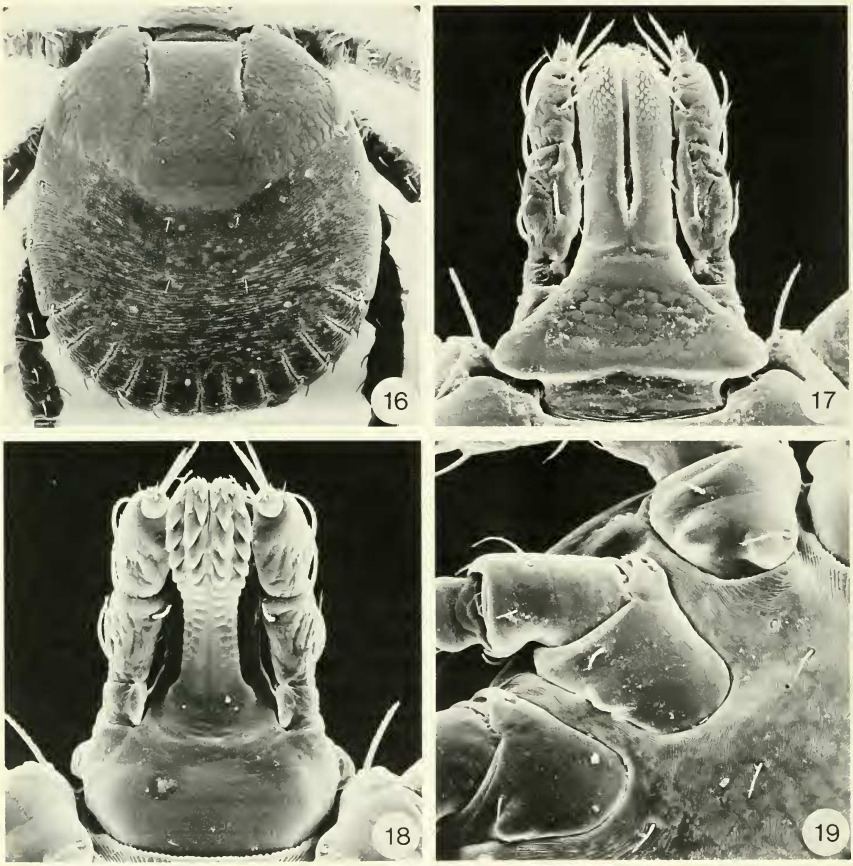
Table 3. *Amblyomma babirussae*: Descriptive statistics for measurements from 15 unengorged nymphs.

Measurement	Mean with Standard Error	Standard Deviation	Coefficient of Variation
Body: length	1.453 ± 0.018	0.068	4.68
width	1.318 ± 0.015	0.059	4.48
Scutum: length	0.725 ± 0.007	0.029	4.00
width	1.017 ± 0.009	0.034	3.34
Basis capituli: length	0.206 ± 0.004	0.017	8.25
width	0.399 ± 0.004	0.016	4.01
Palps: length	0.449 ± 0.006	0.025	5.57
width	0.089 ± 0.002	0.006	6.74
Hypostome: length of toothed portion	0.197 ± 0.002	0.007	3.55
Tarsus I: length	0.470 ± 0.008	0.030	6.38
width	0.131 ± 0.002	0.008	6.11

12) subquadrate, without ornamentation; cornua present as faint rounded extensions of posterolateral margins; posterior margin between cornua straight. Ventrally (Fig. 13), basis with posterior margin convex but indented before joining lateral margins. *Palpi* ca. 5× longer than wide; 0.406–0.490 (0.449) long, 0.079–0.100 (0.089) wide; segment II ca. 2× as long as segment III; segments decreasing in size in the order II, III, I, IV; setae as illustrated. *Hypostome* rounded and notched apically; length of toothed portion (minus crenulations) 0.180–0.207 (0.197); dentition 3/3 throughout; 7–8 teeth

Table 4. *Amblyomma babirussae*: Descriptive statistics for measurements from 25 unengorged larvae.

Measurement	Mean with Standard Error	Standard Deviation	Coefficient of Variation
Body: length	0.721 ± 0.003	0.013	1.80
width	0.720 ± 0.003	0.016	2.22
Scutum: length	0.291 ± 0.001	0.007	2.41
width	0.563 ± 0.003	0.013	2.31
Capitulum: length	0.342 ± 0.002	0.009	2.63
width	0.215 ± 0.001	0.006	2.79
Palps: length	0.205 ± 0.001	0.006	2.93
width	0.052 ± 0.000	0.002	3.85
Hypostome: length of toothed portion	0.098 ± 0.001	0.004	4.08
Tarsus I: length	0.252 ± 0.001	0.006	2.38
width	0.089 ± 0.000	0.002	2.25
Distance between posthypostomal setae	0.049 ± 0.001	0.004	8.16
Setal lengths			
ST_1	0.026 ± 0.000	0.002	7.69
SC_3	0.015 ± 0.000	0.001	6.67
PA_1	0.025 ± 0.000	0.002	8.00
PA_2	0.027 ± 0.000	0.001	3.70
MV_1	0.032 ± 0.001	0.003	9.38
MD_1	0.029 ± 0.001	0.003	10.34
MD_8	0.028 ± 0.001	0.003	10.71
CD_1	0.021 ± 0.000	0.002	9.52
CD_2	0.025 ± 0.001	0.003	12.00



Figs. 16–19. *Amblyomma babirussae* Larva SULAWESI (RML 99902). 16, Dorsal view (127×). 17, Capitulum, dorsal view (318×). 18, Capitulum, ventral view (318×). 19, Coxae I–III (318×).

in file 1, 6–7 teeth in file 2, 5–7 teeth in file 3; all files diminishing to crenulations basally; numerous minute denticles of corona in 2 or 3 transverse rows arranged 5/5 or 6/6.

Legs (Fig. 14): Coxa I with a broadly rounded internal spur and elongate external spur; coxae II, III and IV each with a rounded external spur; external spurs gradually decreasing in size posteriorly; setae: 4 on coxa I, 3 on II–IV. Trochanters without spurs. Tarsus I 0.423–0.520 (0.470) long; 0.119–0.144 (0.131) wide. *Spiracular plate* (Fig. 15) sunken at macula.

Descriptive statistics for principal characters of nymphs are summarized in Table 3.

Larva (Figs. 16–19).—Measurements from 25 unengorged specimens. Chaetotaxic terminology is that of Clifford and An-

astos (1960). *Body* (Fig. 16) nearly circular, widest just posterior to coxa III. Length from center of emargination to posterior body margin 0.689–0.749 (0.721); width 0.686–0.756 (0.720). Dorsal body setae number 10 pairs: 2 pairs central dorsals, CD_1 0.016–0.027 (0.021), CD_2 0.022–0.031 (0.025); 8 pairs marginal dorsals, MD_1 0.024–0.035 (0.029), MD_8 0.022–0.035 (0.028). Ventral setae usually 15 pairs: 3 pairs sternals, ST_1 0.023–0.030 (0.026); 2–3 pairs (2.06) preanals, PA_1 0.022–0.028 (0.025), PA_2 0.024–0.030 (0.027); 4–5 pairs (4.02) premarginals; 5 pairs marginal ventrals, MV_1 0.024–0.038 (0.032); 1 pair anals. Festoons longer than wide, separated by prominent grooves. Sensilla auriformia 7–9 pairs (8.00) dorsally, 12–14 pairs (12.70) ventrally. Four pairs dorsal sensilla sagittiformia: one pair near posterior margin of scutum at level of MD_1; one pair just anterior to MD_3; one pair situated midway between CD_2 and festoons 2; one pair within festoons 5. Eight pairs ventral sensilla sagittiformia: one pair between coxa I and body margin; one small pair between internal spur of coxa I and ST_1; two pairs posterior to each of coxae II and III, the internal sensillum smaller in both cases; one pair between PM_3 and festoons 3; one pair within festoons 4. *Scutum* (Fig. 16): Length 0.280–0.304 (0.291), width 0.534–0.578 (0.563); 3 pairs of setae, SC_3 0.011–0.016 (0.015); cervical grooves deep and parallel, extending to level of SC_2; one pair of conspicuous auriform-like sensilla between cervical grooves, posterior to SC_1; median sensillum between SC_3; eyes convex, length more than twice width, deeply pigmented and with an orange border in preserved specimens.

Capitulum (Figs. 17, 18): Length from apex of hypostome to posterior ventral margin of basis 0.320–0.359 (0.342); width 0.204–0.228 (0.215). *Basis capituli* dorsally (Fig. 17) subtriangular, lateral margins broadly rounded, posterior margin shallowly concave or indented; cornua absent. Ventrally (Fig. 18), basis with rounded lateral and posterior margins. One pair of minute posthypostomal setae, distance between them 0.044–0.062 (0.049). *Palpi* 0.188–0.216 (0.205) long, 0.050–0.056 (0.052) wide; sutures between segments distinct; segments II and III each more than twice as long as I and IV; segment I with a ventral ridge; segment II with a dorsal ridge along internal margin; setae: 0 on segment I, 4 dorsally and 2 ventrally on both II and III, 12 on IV. *Hypostome* rounded and notched apically; length of toothed portion (minus crenulations) 0.090–0.106 (0.098); dentition 2/2 throughout; 5–6 teeth in file 1, 4–5 teeth in file 2; minute denticles of corona in 2 or 3 transverse rows, each arranged 3/3.

Legs (Fig. 19): Coxa I with a broadly rounded internal spur and a longer external spur bisecting posterior coxal margin; coxa II with a single wide spur near center of posterior margin; coxa III with a low, somewhat triangular spur skewed mesad and barely overlapping posterior margin; setae: 3 on coxa I, 2 on II, 2 on III. Trochanters without spurs. Tarsus I 0.236–0.260 (0.252) long, 0.084–0.094 (0.089) wide. Descriptive statistics for salient characters of larvae are summarized in Table 4.

Schulze (1933) described *A. babirussae* from two collections: 3 males, 7 females, 2 nymphs collected on "*Sus babirussa*" (= *Babyrousa babyrussa*), "Vaterland Boeroe oder Celebes," and 3 nymphs collected by O. Warburg at Minahassa (= Minahasa peninsula), northern Celebes. He deposited the first collection in the Zoologisches Museum, Greifswald, and selected one male as the "type." The collection of 3 nymphs was deposited in the Zoologisches Museum, Hamburg. However, when Frau Helene Schulze donated her husband's tick collection to the Rocky Mountain Laboratory, it contained one slide-mounted female of *A. babirussae* (RML 118517) without any collecting data and 2 nymphs of *A. babirussae* (RML 46433) in alcohol, collected by O. Warburg, Min-

Table 5. *Amblyomma babirussae* examined from Sulawesi, Indonesia.

Number of Ticks ♂	♀	N	L	Locality	Month	Remarks
Mammalia (Human)						
1				Trail to Kulawi	Aug.	Riding horse
1				Tomado	Aug.	On leg; trail on mountain behind Tomado
3	1			Tokalosi	Sep.	In forest
Perissodactyla: Equidae Domestic horse						
1				Lake Lindu, Tomado	Aug.	♂ horse
3	2	18		Lake Lindu, Langko	Oct.	♂ horse
Artiodactyla: Suidae *Sus scrofa*						
1	27	1		Lake Lindu (nr)	Aug.	
4	9	2		Soroako	Aug.	From two pigs
		2		Gumbasa Valley, Gumbasa	Jan.	
		12		Lake Lindu, Tomado	Oct.	
	6	6		Lake Lindu, Luo	Oct.	Wild pig
	1	3		Lake Lindu, Lembo	Nov.	Wild pig
4	8	10		Lake Lindu, Palili-Luo	Dec.	Wild pig
4	9			Lake Lindu, Bamba	Mar.	Wild pig (2 colls.)
4	7	11		Lake Lindu, Bamba	Mar.	
11	20	1		Lake Lindu, Anca	May	♂ pig
14	21	1		Lake Lindu, Bamba	Jun.	♂ pig (2 colls.)
Artiodactyla: Cervidae *Cervus timorensis*						
	6	3		Lake Lindu (NE side), Luo	Jul.	ex 1 ♂, 1 ♀ deer
1		4		Lake Lindu, Palili	Jul.	deer (2 colls.)
8	10	1		Soroako	Aug.	(2 colls.)
		9		Lake Lindu, Palili	Aug.	
	3	18		Lake Lindu, Palili	Dec.	
6	29	21		Lake Lindu, Bamba	Dec.	
1				Luwa Kabupaten, Tedeboe	Jul.	
	4	2		Lake Lindu, Luo	May	deer (2 colls.)
	1	1		Lake Lindu, Wongkodono	Mar.	
	1	4		Lake Lindu, Anca	Mar.	
3	5	4		Lake Lindu, Anca	Nov.	
1	2	4		Lake Lindu, Anca	May	
	4			Lake Lindu, Kati	May	
Artiodactyla: Bovidae *Bubalus* (*Anoa*) *depressicornis*						
6	28	6		Lake Lindu, Palili	Dec.	
1	6	8		Lake Lindu, Paku	Oct.	(2 colls.)
	29	4		Lake Lindu, Tomado	May	(2 colls.)
Artiodactyla: Bovidae Domestic buffalo						
4	7	7		Lake Lindu, Tomado	Jul.	
8	1	2		Trail from Lake Lindu to Kulawi	Aug.	
7	10			Soroako	Aug.	
1	2	1		Lake Lindu, Paku	Aug.	♂ buffalo (2 colls.)
	1			Lampesue	Sep.	

Table 5. Continued.

Number of Ticks				Locality	Month	Remarks
♂	♀	N	L			
6	4	2		Lake Lindu, Paku	Oct.	(4 colls.)
	2	1		Lake Lindu, Tomado	Oct.	(2 colls.)
1	2	2		Lake Lindu, Anca	Oct.	
1				Lake Lindu, Paku	Mar.	
Domestic cattle						
	1			Parigi	Jun.	cow
		5		Lake Lindu, Paku	Aug.	
1	2	21		Lake Lindu, Malo	Sep.	2 cows
	1			Lake Lindu, Paku	May	cow
Carnivora: Viverridae						
Viverra tangalunga						
		1		Lake Lindu, Puro	Jan.	
Rodentia: Muridae						
Rattus exulans						
		1		Lake Lindu (W side), Wongkodono	Jul.	
		2		Lake Lindu	Aug.	rat (3 colls.)
	2	5		Lake Lindu, Dono	Oct.	♀ rat
1				Lake Lindu, Bamba	May	♀ rat
Rattus hoffmanni						
		2		Gumbasa Valley, Gumbasa	Jan.	♀ rat (2 colls.)
	2			Lake Lindu, Lomba	May	
Miscellaneous Vegetation						
2				Lake Lindu, Tomado	May	
2	1	5		Donggala, trail from Kulawi to Lake Lindu	Jul.	
4	6	12		Lake Lindu, nr. Tomado	Jul.	(2 colls.)
5	3	5	±15	Lake Lindu, Antja	Jul.	Forest pasture
		3	1	Lake Lindu, Tomado		Near wallow of *Babyrousa babyrussa*
	5			Trail from Lake Lindu to Kulawi	Jul.	
		5		Lake Lindu, Paku	Aug.	
4	3	6		Lake Lindu, Anca	Aug.	(2 colls.)
	1		5	Lake Lindu, Tomado	Sep.	
		4	4	Lake Lindu, Paku	Sep.	
1	4	21		Lake Lindu, Langko	Sep.	(2 colls.)
		20		Lake Lindu, Anca	Sep.	
	1	9		Lake Lindu, Langko	Oct.	(2 colls.)
1				Nuara Gumbasa	Aug.	
		2		Nuara Gumbasa	Sep.	
2		15	1	Malapi	Aug.	
1	2	5		Tokalosi	Sep.	
	4	11	12	Lake Lindu, Tomado	Oct.	(7 colls.)
	2	3		Lake Lindu, Lembo	Oct.	
	1			Gunung Mogogonipa	Aug.	

ahassa, northern Celebes, 24 Nov. 1890. G. Müller of the Zoologisches Museum, Greifswald, has informed us that his staff found no type specimens of *A. babirussae* in their tick collection, nor was there ever an entry recorded for *A. babirussae* in their type-card index file. Furthermore, Gisela Rack of the Zoologisches Museum, Hamburg, assures us that no nymphs of *A. babirussae* are in their tick collection, so undoubtedly 2 of the 3 nymphs collected by O. Warburg are now in our collection at the Museum Support Center.

Our slide-mounted female *A. babirussae* (RML 118517) is in all probability one of the 7 females from *Babyrousa babyrussa* and we designate RML 118517 as lectotype female *Amblyomma babirussae,* so mark it and deposit it in the Museum Support Center, Smithsonian Institution. The 2 nymphs in alcohol (RML 46433) are designated paralectotypes.

Species Relationships

Anastos (1950), in his review of the Indonesian Ixodidae, listed three species of *Amblyomma* from Sulawesi: *A. babirussae, A. testudinarium* and *A. cyprium cyprium.* The presence of a triangular pointed spur on coxae II and III separates adults of both *A. babirussae* and *A. c. cyprium* from *A. testudinarium,* which has a broad rounded spur on coxae II and III. Adults of *A. babirussae* can be separated from *A. c. cyprium* by the presence in *A. babirussae* of large deep scutal punctations and an external spur on coxa I that is much longer than the internal, whereas in *A. c. cyprium* the scutal punctations are small and shallow and coxa I has an external spur only slightly longer than the internal.

Since the Anastos review, two additional species of *Amblyomma* have been reported from Sulawesi, *A. cordiferum* and *A. helvolum* (Lazell et al., 1987). Female *A. cordiferum* have 2 spurs on coxae II and III and an inornate scutum. Males of *A. cordiferum* are undescribed. Female *A. babirussae* have a single spur on coxae II and III and an ornate scutum. Adult *Amblyomma helvolum* are small *Aponomma*-like ticks with indistinct eyes and a 3/3 hypostomal dentition. Adult *A. babirussae* are rather large robust ticks with obvious eyes and 4/4 hypostomal dentition.

Distribution and Hosts

Specimens of *A. babirussae* are relatively rare in museum collections and thus far are known only from Sulawesi and perhaps Boeroe Island. This tick has been collected from most areas of Sulawesi and at altitudes from sea level to over 1800 meters.

Data presented in Table 5 indicate that *A. babirussae* can be collected throughout the year and apparently prefers to feed on larger artiodactyls.

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Note

Baetis caelestis Allen and Murvosh, an available name for *Baetis* sp. A of Morihara and McCafferty (Ephemeroptera: Baetidae)

Morihara and McCafferty (1979. Trans. Am. Entomol. Soc. 105: 139–221) in their revision of the *Baetis* larvae of North America included three unnamed but otherwise comprehensively described species as *Baetis* sp. A, *Baetis* sp B [= *Baetis magnus* McCafferty and Waltz (1986. Proc. Entomol. Soc. Wash. 88: 604)], and *Baetis* sp. C. These were initially unnamed because, although distinctive, the possibility remained that they were associated with formerly named adults since they had not been reared.

Baetis sp. A was based on larvae from Castron and Otero counties in New Mexico and Los Angeles County, California. We have just recently acquired the original material of Baetis from Baja California described by Allen and Murvosh (1983. Ann. Entomol. Soc. Am. 76: 425–433). From our comparative examinations we have determined that *Baetis caelestis* Allen and Murvosh is an available name for *Baetis* sp. A of Morihara and McCafferty. The Allen and Murvosh type material was made up of a mixture of larvae, some of which we have identified as *Baetis tricaudatus* Dodds. The holotype, however, is clearly identifiable as *Baetis* sp. A. Our finding is based in part on the presence of robust setae on the serrate margins of the gills.

We call attention to the equivalency of *Baetis* sp. A to *Baetis caelestis* because *Baetis caelestis,* based on the original description and discussion that followed, cannot be distinguished from many other species of *Baetis* or even placed in the *rhodani* species group, to which it belongs. If reference is made to *Baetis* sp. A, however, *Baetis caelestis* larvae can be readily distinguished by the description, figures, and key of Morihara and McCafferty (1979). Unfortunately, due to an inadvertent inversion of letters in that key, users should note that *Baetis caelestis* will key to sp. B and *Baetis magnus* will key to sp. A.

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